

Newport, 5 inches. *Tennessee*: Ashwood, 2½ inches; Nashville, 2 inches; Memphis, 4 inches; Chattanooga, 1 inch. *Texas*: Henrietta, 1½ inches; Denison, trace. *Utah*: Coalville, 4 inches; Salt Lake City, 1 to 3 inches. *Vermont*: Newport, 3 inches; Strafford and Woodstock, 6 inches; Burlington, ½ inch. *Virginia*: Accotink and Wytheville, 5 inches; Lynchburg, 3½ inches. *Washington Territory*: Dayton, 3 inches; Olympia, 2 inches. *West Virginia*: Morgantown and Wellsburg, 5 inches; Helvetia, 4 inches; Flemington, 2 inches. *Wisconsin*: Neillsville, 7 inches; Embarrass, 5 inches; La Crosse, 3½ inches; Madison, trace.

*Rain or Snow from a Cloudless Sky*.—Burlington, Vt., 2d, 4th, light snow; 22d, light snow at intervals during the day and night. Mobile, 10th, 7.45 p. m., light rain, lasting about five minutes, during which 0.01 inch fell. Buffalo, 22d, light snow. Dubuque, Ia., 2d, light snow from 8.05 to 8.25 a. m.; Ardenia, N. Y., 24th, between 4 and 5 p. m.

*Hail*.—Portland, Or., 25th; San Francisco, 24th, during a heavy shower of rain at 3.40 p. m., hail was reported to have fallen in several sections of the city. Sacramento, Cal., 31st. Red Bluff, Cal., 23d, hail-stones size of peas; 25th, from 5.10 to 5.15 p. m., size of peas; Visalia, Cal., 10th, 6 p. m., a sudden and heavy fall of hail lasting 10 minutes; Fort Canby, Wash. Ty., 31st.

*Sleet*.—The dates on which sleet fell in the various districts are as follows: New England, 1st, 6th, 8th to 11th, 13th, 16th, 26th, 27th; Middle Atlantic States, 4th, 5th, 8th to 12th, 16th to 19th, 22nd, 25th, 26th, 28th, 31st; South Atlantic States, 1st, 25th, 26th, 30th, 31st; East Gulf States, 29th; West Gulf States, 16th, 17th, 18th, 29th; Rio Grande Valley, 17th; Ohio Valley and Tennessee, 3rd, 4th, 6th, 10th, 12th, 13th, 15th to 18th, 24th, 25th, 30th, 31st; Lower Lake Region, 6th, 10th, 12th, 21st, 25th; Upper Lake Region, 6th, 7th, 8th, 13th, 26th; Upper Mississippi Valley, 4th to 7th, 10th, 12th, 16th, 20th, 24th, 26th; Missouri Valley, 4th, 10th, 16th, 26th, 30th; Northern Slope, North Platte, 12th; Middle Slope, 10th, 12th, 16th, 20th, 24th, Southern Slope, 16th, 17th, 29th; Southern Plateau, Tucson, 16th; Middle Plateau, Pioche, 24th; Northern Plateau, Fort Missoula, Mont., 2nd, and Dayton, Wash. Ter., 25th.

#### RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges as follows: New England, from 68 to 77; Middle Atlantic States, 69 to 87; South Atlantic States, 70 to 87; Florida Peninsula, 76 to 79; East Gulf States, 75 to 84; West Gulf States, 71 to 90; Rio Grande Valley, 78 to 91; Ohio Valley and Tennessee, 73 to 83; Lower Lake Region, 71 to 86; Upper Lake Region, 70 to 87; Extreme Northwest, 66 to 95; Upper Mississippi Valley, 63 to 78; Missouri Valley, 64 to 72; Northern Slope, 56 to 75; Middle Slope, 47 to 74; Southern Slope, 48 to 81; Southern Plateau, 54 to 64; Middle Plateau, 53 to 72; Northern Plateau, 73 to 85; North Pacific Coast Region, 83 to 85; Middle Pacific Coast Region, 68 to 70; South Pacific Coast Region, 57 to 70. *High stations* report the following percentages not corrected for altitude: Santa Fe, 67.9; Denver, 56.8; Pike's Peak, 77.4; Mt. Washington, 86.1.

#### WINDS.

The prevailing winds during the month of January, 1882, at Signal Service stations, are shown on chart No. II, by arrows which fly with the wind. In the Middle Atlantic States and New England the winds are *northwesterly*; in the South Atlantic States, *southwesterly*; in the Gulf States and Florida Peninsula, *southerly*; in the Ohio Valley and Tennessee, *south-west to northwest*; in the Lake Region, *southwesterly*; in the Upper Mississippi and Lower Missouri Valleys and in the Red River of the North Valley, *southerly*; in the Northern Slope, *northwesterly*; in the Middle and Southern Slopes, *south to west*; in the Plateau Regions, *variable*; in the North Pacific Coast Region, *southerly* and in California, *northerly*.

*Total Movements of the Air*.—The following are the largest total movements at Signal Service stations: Mt. Washington,

28.892 miles; Pike's Peak, 19.172; New Shoreham, R. I., 13.733; Delaware Breakwater, 13.423; Thatcher's Island, Mass., 12.602; Sandy Hook, 11.955; Hatteras, 11.501; Kittyhawk, 11.436; Cape May, 11.310; Sandusky, 10.841; Rochester, 10.793; Buffalo, 10.651; Barnegat, 10.557; Grand Haven, 10.292; Indianola, 10.135; Ft. Shaw, Mont., 10.039; Cape Henry, Va., 9.879; Newport R. I., 9.612; Eastport, 9.386; Chincoteague, Va., 9.301; Portsmouth, N. C., 9.280; Oswego, 9.125; Champaign, Ill., 9.070; Milwaukee, 8.962; Macon, N. C., 8.960; Erie, 8.908; Huron, Dak., 8.829; Boston, 8.742; Cleveland, 8.609; Galveston, 8.597; Detroit, 8.536; Dodge City, 8.500; Cheyenne, 8.328; Ft. Elliott, Tex., 8.301; Burlington, Vt., 8.185; Port Huron, 8.160; Marquette, 8.134; Atlanta, 8.088; North Platte, 8.046; Ft. Assinnaboine, Mont., 8.040. The *smallest* are: La Mesilla, N. M., 1.221; Rio Grande, Tex., 1.236; Roseburg, Or., 1.762; Ft. Missoula, Mont., 1.800; Salt Lake City, 2.100; Florence, Ariz., 2.177; Lynchburg, 2.338; Silver City, N. M., 2.541; Tucson, Ariz., 2.812; Boise City, Idaho, 2.863.

*High Winds*.—The following are maximum velocities, with direction at time of occurrence, for the various dates on which 50 miles per hour was exceeded, on the summit of Mt. Washington; 100 miles, NW., 2d; 70, NW., 3d; 88, N., 4th; 68, S., 6th; 82, NW., 7th; 92, W., 8th; 100, NW., 9th; 80, NW., 10th; 100, NW., 11th; 88, NW., 12th; 100, W. and SW., 13th; 110, NW., 14th; 120, NW., 15th; 65, NW., 16th; 97, NW., 17th; 88, W., 18th; 60, NW., 19th; 60, NW., 20th; 60, SW., 21st; 120, NW., 22d; 88, NW., 23d; 96, NW., 24th; 67, NW., 25th; 65, NW., 26th; 126, NW., 27th; 72, SW., 28th; 120, NW., 29th; 116, NW., 30th; 58, NW., 31st. On the summit of Pike's Peak the following maximum velocities were reported: 62 miles, NW., 1st; 54 W. and NW., 5th; 50, SW., 6th; 50, NW., 21st; 54, SW., 24th; 52, W., 26th. Other stations reporting velocities of 50 miles per hour or over are as follows: Ft. Stevenson, Dak., 56, NW., 17th; Indianola, 53, N., 16th; Grand Haven, 50, NW., 26th; Sandusky, 51, W., 22d; Buffalo, 51, SW., 27th; Rochester, 56, W., 27th; Champaign, Ill., 52, W., 26th; Thatcher's Island, Mass., 52, NE., 2d, and 57, NW., 27th; New Shoreham, R. I., 50, N., 1st and 2d, and 55 NE., 31st; Sandy Hook, 54, E., 31st; Cape May, 54, NW., 14th, 63, W., 22d, and 52, NW., 29th; Delaware Breakwater, 52, NW., 22d and 29th; Cape Henry, Va., 52, NW., 1st.

*Local Storms*.—Most of the following storms attended the development and progress of low areas Nos. XII and XIII. The latter rapidly succeeded the former and pursued its general course, and the partial restoration of atmospheric equilibrium between the passage of the two storm centres caused sudden and violent westerly gales at many points in the northern districts. Ventura Co., Cal., 12th, very violent wind storm (said to be a tornado) occurred in the Ojai valley, destroying houses and barns and uprooting and breaking off the strongest trees. Wilmington, Cal., 12th, most terrible storm for many years, accompanied by a blinding fall of snow and sleet; several vessels dragged anchor in the harbor, and one of them became a total wreck. Oakland, Cal., 13th, heavy northerly gale, signs destroyed, fences blown down, trees uprooted, wind mills dismantled and several houses damaged. Martinsburg, N. Y., 26th, very violent wind storm, over 25 buildings more or less demolished. Lowville, N. Y., many buildings unroofed and some entirely demolished. Harrisburg, N. Y., 27th, barns unroofed. Greig, N. Y., 27th, barns and houses unroofed and other property damaged. Constableville, N. Y., 27th, barns unroofed, fences blown down and trees uprooted. High Market, N. Y., 27th, several buildings unroofed. San Diego, Cal., 12th, most remarkable storm since 1847, a period of 34 years; continuing for 38 hours, it gave the largest rainfall of any one storm in the month of January during the above period, and the largest but two of all the storms recorded. It was especially remarkable as being the coldest storm of which there is any record. On the morning of the 14th snow-flakes were observed, melting as fast as they fell, a phenomenon

never before noted at this station, which fact is verified by persons who have resided in San Diego for the past 40 years. Very rarely and at long intervals light snow has been seen on the summit of San Miguel Mountain, 15 miles distant. Snow is frequently seen on the Cuyamaca Peaks, 45 miles to the northeast, and occasionally on Lyons peak, 35 miles eastward. But accompanying this storm, snow varying in depth from two to five inches was reported from the low hills at El Cayon, Poway, Bernardo, and other points within 15 to 25 miles of station, "where such a thing was never before experienced." The magnitude of the fall of rain and snow was such, that 12 hours from the commencement of the storm San Diego river began flowing into False Bay, a "change almost unprecedented." In this connection the following comparative statement of January rainfalls will be found of interest: 1871, 0.69 inch; 1872, 0.99; 1873, 0.44; 1874, 3.11 inches; 1875, 2.38; 1876, 2.47; 1877, 1.05; 1878, 1.45; 1879, 3.54; 1880, 0.61; 1881, 0.52; 1882, (to date, January 13th) 3.02 inches. Oswego, N. Y., 27th, about 5 a. m., severe wind storm, considerable damage to telegraph and telephone wires; buildings unroofed, fences and trees blown down and much other damage caused; severest gale experienced for several years. Thompsonville, Conn., 27th, several buildings unroofed and considerable damage caused to farmers in the surrounding country. Stamford, Conn., 27th, one large building demolished and much damage to trees, fences and houses. Brattleboro, Vt., 27th, trees uprooted and broken down and several buildings demolished. North Hinsdale, Vt., 27th, buildings unroofed and telegraph and telephone wires rendered useless. Chesterfield, Vt., 27th, buildings blown down and forest trees uprooted. Westfield, Mass., 27th, considerable damage to buildings, fences and shade trees. Joplin, Mo., 15th, very heavy wind storm, demolishing trees, fences and out-buildings. Troy, N. Y., 27th, heavy westerly gale, causing much damage to property. Lansingburg, N. Y., 27th, several buildings unroofed. Castleton, N. Y., 27th, buildings unroofed and other property considerably damaged. Mineville, N. Y., 27th, several buildings blown down and other property damaged. Wilmington, Vt., 27th, considerable damage to trees and buildings. Marlboro, Vt., 27th, very heavy wind storm, causing much damage to property. Keene, N. H., 27th, several buildings blown down and quite a number unroofed. Winchester, N. H., 27th, large number of barns unroofed and houses partially demolished. Greenfield, Mass., 27th, several buildings unroofed and blown down. Schools were closed from fear of damage to buildings. Holyoke, Mass., 27th, considerable damage to property by the unroofing of buildings and the destruction of trees and fences. Southwick, Mass., 27th, buildings unroofed and otherwise damaged. Lewiston, Me., 27th, considerable damage to windows, fences, signs, chimneys and church steeples. Burlington, Vt., 27th, heaviest wind storm for many years; great destruction of property by the unroofing and blowing down of buildings; large trees uprooted or broken off. The ice in Burlington bay and Lake Champlain was swept out of sight with "amazing rapidity." Much havoc took place in the various lumber yards. Pittsfield, Mass., 27th, 9 a. m., very heavy wind storm, unroofing buildings, destroying trees and causing considerable damage in the surrounding country. In the city business was almost entirely suspended, "horses and sleighs were blown prostrate as the gale struck them and the streets were strewn with large quantities of debris." Most violent storm since the "terrible tornado" of July 16th, 1879. Saratoga, N. Y., 27th, heavy wind storm during early morning proving very destructive in surrounding country. Rockland, Me., 27th, several buildings unroofed and some damage to shipping in harbor. Chelsea, Me., 27th, several buildings demolished. East Concord, N. H., 27th, considerable damage to property. Chicopee, Mass., 27th, bridge over the Connecticut river destroyed; several buildings damaged. Lynn, Mass., 27th, several buildings unroofed and otherwise damaged. Rochester, N. H., 27th, several buildings damaged and other property destroyed. Cheshire, Mass., 27th, heavy wind storm; steam engine house

and ice-houses, the property of the Housatonic Ice Company were blown down; several other buildings completely demolished. Loss to property over \$5,000. North Adams, Mass., 27th, three large brick buildings aggregating over 800 feet in length, belonging to the Zylorite Works, were completely demolished. Newburyport, Mass., 27th, several buildings unroofed and otherwise damaged. Nashua, N. H., 27th, very heavy wind storm, considerable damage to property. Springfield, Mass., 27th, heavy wind storm about 10 p. m., considerable damage in city and surrounding country. West Turin, N. Y., 27th, considerable property destroyed. Naumburg, N. Y., 27th, barns unroofed and other buildings badly damaged; loss of property in vicinity quite severe. The gale was accompanied by rain, which began about 2 p. m. "The western sky was very dark and immense dark masses of cloud passed rapidly from west to east during the storm." Rondout, N. J., 27th, houses and other buildings unroofed, fences demolished and trees uprooted; severest wind storm for several years. Along the line of the Ulster and Delaware R. R. a great many telegraph poles were "broken off or torn out of the ground." Ancram, Dutchess, Co., N. Y., 27th, large destruction of property in town and surrounding country. Winthrop, Me., 27th, heavy westerly gale; considerable damage to property. Ballston Spa, N. J., 27th, heaviest wind storm experienced for several years; much damage to property. Bloodville, N. J., 27th, very heavy wind storm; buildings damaged. Rock City, N. Y., 27th, heavy wind storm; considerable property destroyed. Wabash, Ind., 26th, buildings unroofed, trees and fences blown down. Fort Wayne, Ind., 26th, heavy westerly gale, damaging buildings and other property. Grand Haven, Mich., 26th, several buildings and other property damaged during a heavy westerly gale.

#### VERIFICATIONS.

*Indications.*—The detailed comparison of the tri-daily indications for January, 1882, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 83.18 per cent. The percentages for the four elements are: Weather, 81.32; Direction of the Wind, 76.27; Temperature, 86.60; Barometer, 88.52 per cent. By geographical districts they are: For New England, 84.0; Middle Atlantic States, 88.0; South Atlantic States, 83.6; Eastern Gulf States, 82.1; Western Gulf States, 80.7; Lower Lake Region, 87.7; Upper Lake Region, 83.6; Tennessee and the Ohio Valley, 85.4; Upper Mississippi Valley, 81.9; Lower Missouri Valley, 76.7; Northern Pacific Coast Region, 83.3; Middle Pacific Coast Region, 82.1; Southern Pacific Coast Region, 85.3. There were 119 omissions to predict (40 being due to the absence of reports from the Pacific coast) out of 3,813, or 3.12 per cent. Of the 3,694 predictions that have been made, 198, or 5.36 per cent. are considered to have entirely failed; 200, or 5.42 per cent. were one-fourth verified; 437, or 11.83 per cent. were one-half verified; 231, or 6.25 per cent. were three-fourths verified; 2,628, or 71.14 per cent. were fully justified, so far as can be ascertained from the tri-daily reports.

*Cautionary Signals.*—97 Cautionary signals were displayed during the month of January, 1882, of which 94, or 96.90 per cent., were fully justified by winds of twenty-five miles per hour, or over, at or within a radius of 100 miles of the station. 109 Off-shore signals were displayed, of which 80, or 73.39 per cent., were fully justified; 94 or 86.23 per cent., were justified as to direction; 106, or 97.24 per cent., were justified as to velocity. Twenty-two Off-shore signals were changed from Cautionary. Two Northwest signals were displayed, both of which were fully justified. 208 signals of all kinds were displayed, of which 176, or 84.61 per cent. were fully justified. The above does not include signals ordered at 69 display stations, where the velocity is only estimated. 147 winds of 25 miles or over, were reported, for which no signals were ordered. 34 signals were ordered late.

#### NAVIGATION.

*Stage of Water in Rivers.*—In the table on the right-hand